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The production of scallop seed in 1971

by

Y. Hayakawa, S. Nishiyama, T. Hondo

Foreword

During the last years, ~~the~~ technique, for collecting naturally scallop seed in the Mutsu Bay has progressed with rapid strides and the juvenile shells obtained have brought to the scallop fisheries in the Mutsu Bay the full volume of production it needed. However, it has not been possible to eliminate satisfactorily the yearly variations in the volumes of seed collected and the supply of seed remains precarious. This is why this center geared its efforts to study the technique of natural seed collection and to find a technique for artificial indoor seed collection. Placing the stress in 1969, 1970 on ~~the obtention of~~ obtaining seed, we were able to produce 210,000 and 100,000 juveniles respectively but also became keenly aware of the need of further research regarding such fundamental questions as rearing water management and feeding. We will report here on some tests conducted this year with regard to the way of rearing swimming larvae.

We first wish to thank the personnel of the fishermen's cooperative in Kawauchi, Shimokita Township for their kind cooperation in the collection of adult scallop, ~~mother shells~~.

Material and method

1) ~~Mother shells~~ Adults

We ~~had~~ used 450 3 ~ 6 years old ~~mother shells~~ adults obtained through 8 collections carried out in Kawauchi at a depth of 13 ~ 17 m from January 18, 1971 to March 29 of the same year. We used 400 ~~shells~~ adults for artificial spawning ~~induction~~ and an ~~survey of the state~~ assessment of gonadal maturity, and 50 for spawning control.

2) Artificial Spawning ~~induction~~ and controlled spawning ~~control~~

By the same method as last year, we ~~performed~~ controlled spawning ~~control~~ from March 28 through April 14.

3) Rearing of swimming larvae

The method employed was practically the same as last year. The density was adjusted to about 1,000 individuals/L. Table 1 shows the rearing temperatures and the tests in water change. Table 2 shows tests about the various kinds of ~~food~~ good and Table 3 tests in larval density.

When the swimming larvae reached the attachment stage (determined by the shell size and the appearance of ocelli), we dropped in the tank a netoron net onion bag to be used as collector.

4) Rearing of the juvenile shells at the attachment stage and after transfer to sea p. 9

We followed roughly the same method as last year.

Results

1) Spawning ~~induction~~ and maturity

Table 4 shows ~~the state~~ results of artificial spawning ~~induction~~. Graph 1 shows the seasonal variations in the state of maturity. From these conditions as well as from the rise in natural seawater temperature at the time (average: 4 - 6°C), we can assume that there was some natural spawning in mid-March although full spawning seemed to take place in late March indeed.

Some males which had been reared for 1 full year indoors exhibited ~~spermatizing reactions~~ some ability to produce sperm although ~~the~~ females did not spawn before two years. The gonad weight vs. soft parts weight ratio was 18 - 20% for the males and more than 20% for the females.

2) Spawning ~~control~~ Controlled

Control was carried out so as to make it possible to rear larvae for a longer time after natural spawning had come to an end.

Although the rate of spawning ~~induction~~ dropped considerably, we were more or less able to achieve our objective and ~~to~~ obtain swimming larvae which could stand rearing. It seems that ~~mother shells~~ adults fully mature by end March can be controlled for three weeks ~~through~~ by temperature lower than 5°C. In the meantime, suitable ~~feed~~ food may be needed in order to avoid aging of the gonads. p. 10

3) Rearing of the swimming larvae

In all cases, the ascent of the larvae was most active about 20 hours after fertilization. After about 50 hours, almost all larvae had reached the early D-type stage. The results yielded through the

rearing temperature and by the water change method are shown in Graphs 2 ~ 5. The results of the tests with the various kinds of ~~feed~~ food are shown in Graph 6. These results were tabulated against the water temperatures in Table 5. The number of days prior to attachment shortened as the temperature of the rearing water rose. However, the yield also decreased and there was a sharp drop in larval quality. On the contrary, at 24°C few individuals were seen to ~~expand their~~ show in shell length and they did not seem to reach the attachment stage. This seems to be related to the fact that 24°C is also a (hazard) lethal temperature to the physiology of adult~~s~~ ~~shells~~.

Feeding was carried out twice a day viz. in the morning and in the evening. Everyday 1/4 ~ 1/3 of the water was changed. About every fifth day, the tank was replaced by a new one and we found that it was advantageous to change the whole water.

The ~~feed~~ food was a mixture of Mc., and Ch. which had been used in the past. We tried to use M.Y. sc as to simplify the culture of ~~feed~~ food but feeding with M.Y. alone was useless. To the contrary it threatened to destroy the water quality. When mixed with Mc. or with Ch. it could apparently be used for the first time, but the results are unclear and we should not be too hopeful. Even when used alone, Mc. and Ch. are conductive to fairly good attachment and yield. Yet the best results are obtained by mixing these feeds.

So far, when rearing larvae the density was 1,000 individuals/L, but we attempted to rear with 2,000 individuals/L. There was no change in growth or in yield and rearing was possible.

Discussion

We managed to rear 37,000,000 larvae up to the early D-type stage. However, the quantity of eggs spawned is not determined by physical factors such as water temperature only, but also by the physiological state of the adult scallop ~~mother shells~~. These points require further research.

We were fairly successful with regard to rearing water temperature, water change methods and types of feed. Our results should prove fairly useful for further rearing. We must also find the appropriate quantity of feed required per individual per day, perform with the juvenile shells at the early attachment period the same types of rearing tests as performed with the swimming larvae, and discover a way to raise the yield as well as a method to rear healthy seed.

We must furthermore perfect the management of the rearing water (physico-chemical analysis) and establish a general production system as to obtain large quantities of healthy seed.

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Table 1 Water temperature and method of changing the water

Water temperature	Water change	Feeding method	Feed and feeding volumes
15°C	Depending on the amount of dirt, the water is entirely changed every 3-5 days; the tank too is is replaced (a)	twice (morning and evening) (A)	Feed: Monochlysis lutheri and Chaetoceros calcitrans
18°C		once in the morning (B)	Volume in numbers of cells: 2,000 cells of (Mc : Ch = 1 : 2) mixture per larva per day from start of rearing till average shell length is 150 μ or 4,000 cells per larva per day till average length is 190 μ or 6,000 cells per larva per day till attachment stage is reached.
21°C	1/4 of the water is changed every day; the whole water is changed and the tank replaced	twice (morning and evening) (C)	
24°C	just before puting the collector back in place (b)	once in the morning (D)	

Table 2 Testing the types of feed

Type of feed	Water change	Volume of feeding and other data
Mc. group Ch. group M.Y. group Mc. Ch. group Mc. M.Y. group Ch. M.Y. group	1/4 ~ 1/3 of the water is changed every day; depending on the amount of dirt, the whole water is changed (about every 5 ~ 6 days); the tank is re-replaced at the same time.	The dry weight of 2,000 Mc. cells is 10^{-4} x 5.45 mg; the same quantities of Ch., M.Y. amount to 4,500 and 7,100 cells respectively. Thus with regard to the volume of feed, conversion is made so as to have in cell numbers Mc. : Ch. : M.Y. = 1 : 2 : 4 and there are 2 feedings (morning, evening). When converting to Mc., the volume was 2,000 cells per larva per day till shell grows to 150 μ; thereafter it is 4,000 cells per larva per day till shell grows to 190 μ; thereafter until attachment, it is 6,000 cells per larva per day. The temperature of the water was 15°C.

(Note) M.Y. means Marine Yeast

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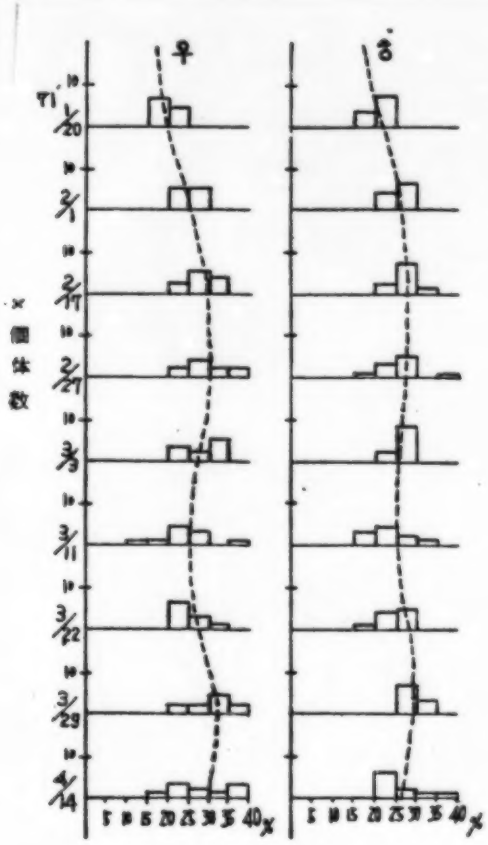
Table 3 Tests in larval density

Number of larvae	Water change, Feed, Other Conditions
2,000 individuals/L	The feed was a mixture of Mc., Ch. Other conditions as in Table 2



第1図 ($\frac{\text{生殖巣重量}}{\text{軟体部重量}}$ × 100 %) の変化

Fig. 1 Variations of ($\frac{\text{weight of gonads}}{\text{weight of soft parts}}$ x 100%)

x number of individuals

Table 4 Spawning induction

第4表 産卵誘発状況

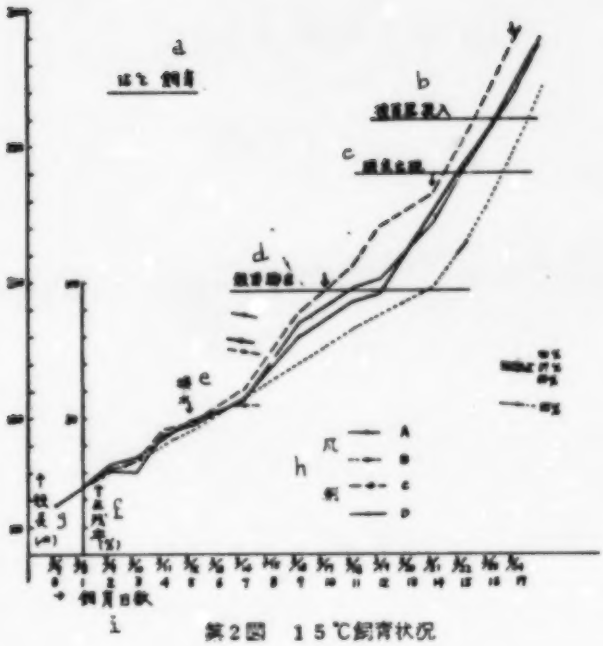
誘発番号[a]	採捕月日[b]	地先水温[c]	誘発月日[d]	母貝数[e] 枚[g]	♂枚	♀枚	誘発率[f] ♂%	♀%	初期D型幼生(万)[h]
1	2/27	3.0	2/27	48	20	28	75.6	28.6	142
2	3/3	3.3	3/4	63	32	31	65.6	48.4	1,500
3	3/11	3.8	3/11	48	27	21	88.9	71.4	600
4	3/20	4.5	3/21	48	21	27	95.2	85.2	800
5	4/13	5.8	4/14	32	19	13	47.0	38.0	550
i 抑制	3/28	5.0	〃	26	15	11	9.0	33.3	120

Key:

a Induction No.
b Collection date
c Water temperature at site
d Induction date
e Number of mother shells
f Induction rate
g number of individuals
h larvae reaching the early D-type (10,000)
i control

Table 5 Water temperature

Water temperature °C	Number of days of attachment	Yield %	Morphology of larvae and other conditions
15	16-20	60-70	average
18	12-14	50-60	some difference in size
21	9-11	30-40	big differences in size
24	unknown	unknown	much deformity; poor growth

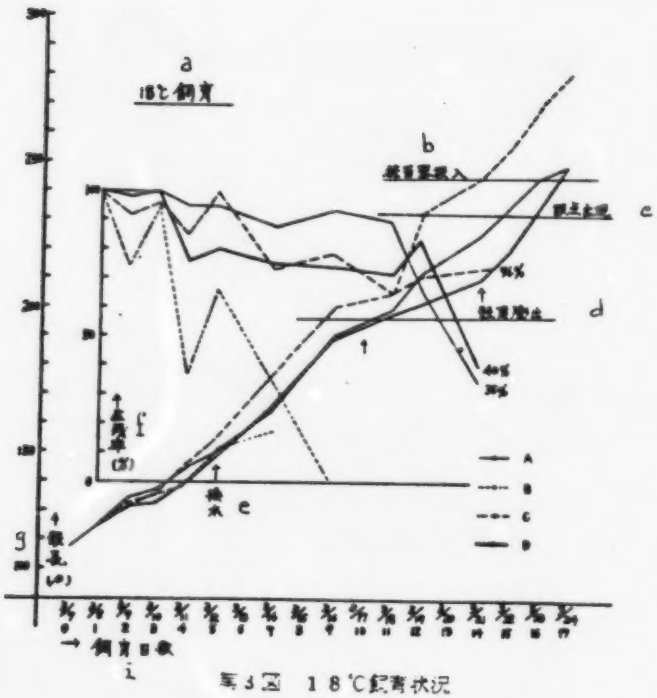


第2図　15℃飼育状況

Graph 2 Rearing at 15°C

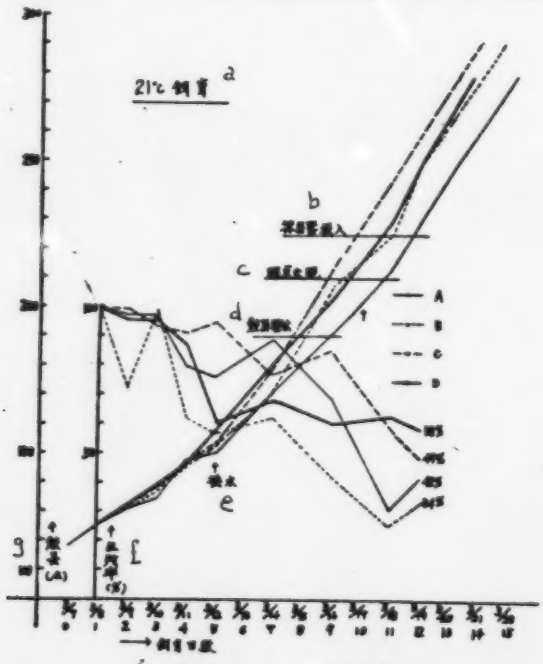
Key:

a rearing
b introducing the collector
c ocelli oppear
d top of shell expands
e water change
f survival rate
g shell length
h legend
i number of rearing days



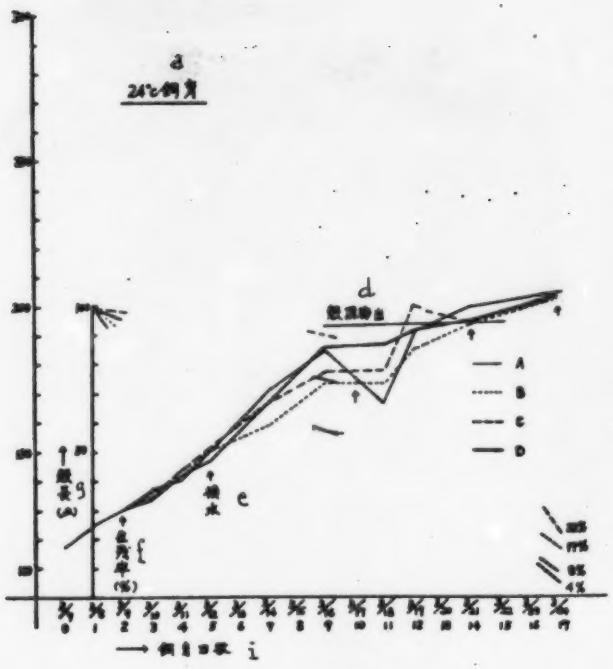
第3図　18℃飼育状況

Graph 3　Rearing at 18°C



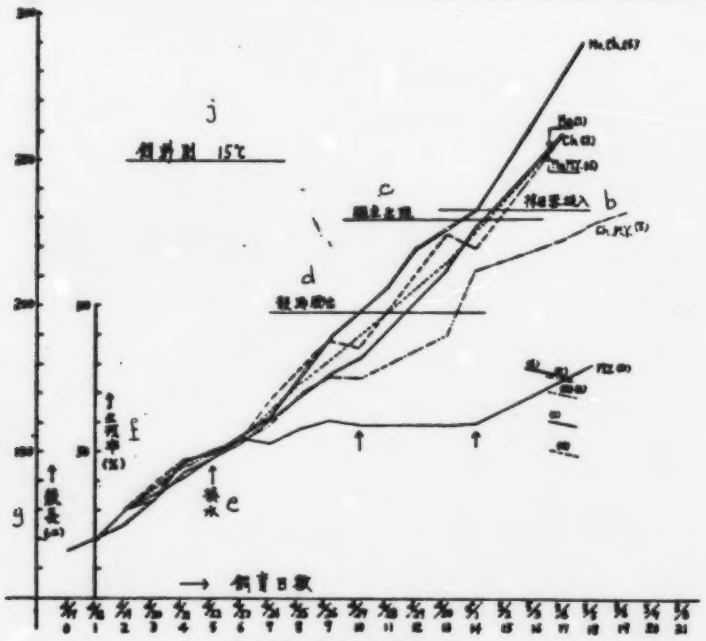
第4図　21℃飼育状況

Graph 4　Rearing at 21°C



第5図　24℃飼育状況

Graph 5　Rearing at 24°C



第6図　飼料別飼育状況

Graph 6　Rearing with different feeds

Key:

j　type of feed 15°C